1. A system used for converting electronic power supply energy as boost converters and other DC to DC converters having, related to the size of the storage inductor, maximal power transferred by recharging the storage inductor right after the point of time when zero current state occurs at the storage inductor comprising:

   a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through the storage inductor and a rectifying means for rectifying the output voltage;

   an analog/digital converter to convert analogue measured values into digital values; and

   a digital control means to control frequency and pulse width of the shunt switch using means to calculate the point of time when zero current state occurs and to calibrate voltage divider ratios.

2. The system of claim **1** wherein a PFC(power-factor-corrector) is used in said boost converter system.

3. The system of Claim **1** wherein said digital control means is using means on the basis of the ON time of said shunt switch and the voltages measured at the source side (rectified mains supply) and at the load side to calculate the point of time when zero current state occurs adding a safety margin to balance inaccuracies of the measurement if required and furthermore initiate the recharging of the storage inductor by said digital control unit right after this point of time.

4. The system of claim **3** wherein a PFC(power-factor-corrector) is used in said boost converter system.

5. The system of Claim **1** wherein said digital control means is using means on the basis of the voltage measured at the load side and of a comparison of said voltage with a reference voltage to fine-adjust the energy transferred by fine-tuning the pulse width of said shunt switch minimising distortion and harmonics overcoming the limitations of discrete time steps in clocked digital systems by toggling between neighbouring ON time values (pulse width) using averaging ON time values of said switch using patterns or a digital delta sigma modulator.

6. The system of claim 5 wherein a PFC(power-factor-corrector) is used in said boost converter system.

7. The system of Claim **1** wherein the accuracy of measurements of voltages required to control the system is improved by using voltage dividers wherein their voltage divider ratios are being calibrated through the operation of the system and said calibrated voltage divider ratios are being considered to define the precise value of the voltages.

8. The system of claim **7** wherein a PFC (power-factor-corrector) is used in said boost converter system.

9. The system of claim **3** wherein said digital control means is using means

on the basis of the ON time of said shunt switch and the voltages measured at the source side (rectified mains supply) and at the load side to calculate the point of time when zero current state occurs adding a safety margin to balance inaccuracies of the measurement if required and furthermore initiate the recharging of the storage inductor by said digital control unit right after this point of time combined with the system of claim **5** wherein said digital control means is using means on the basis of the voltage measured at the load side and of a comparison of said voltage with a reference voltage to fine-adjust the energy transferred by fine-tuning the pulse width of said shunt switch minimising distortion and harmonics overcoming the limitations of discrete time steps in clocked digital systems by toggling between neighboring ON time values (pulse width) using averaging ON time values of said switch using patterns or a digital delta sigma modulator.

10. The system of claim **9** wherein a PFC(power-factor-corrector) is used in said boost converter system.

11. The system of Claim **3** wherein said digital control means is using means on the basis of the ON time of said shunt switch and the voltages measured at the source side (rectified mains supply) and at the load side to calculate the point of time when zero current state occurs adding a safety margin to balance inaccuracies of the measurement if required and furthermore initiate the recharging of the storage inductor by said digital

control unit right after this point of time combined with the system of claim **7** wherein the accuracy of measurements of voltages required to control the system is improved by using voltage dividers wherein their voltage divider ratios are being calibrated through the operation of the system and said calibrated voltage divider ratios are being considered to define the precise value of the voltages.

12. The system of claim **11** wherein a PFC (power-factor-corrector) is used in said boost converter system.

13. The system of Claim **5** wherein said digital control means is using means on the basis of the voltage measured at the load side and of a comparison of said voltage with a reference voltage to fine-adjust the energy transferred by fine-tuning the pulse width of said shunt switch minimising distortion and harmonics overcoming the limitations of discrete time steps in clocked digital systems by toggling between neighboring ON time values (pulse width) using averaging ON time values of said switch using patterns or a digital delta sigma modulator combined with the system of claim **7** wherein the accuracy of measurements of voltages required to control the system is improved by using voltage dividers wherein their voltage divider ratios are being calibrated through the operation of the system and said calibrated voltage divider ratios are being considered to define the precise value of the voltages.

14. The system of claim **13** wherein a PFC (power-factor-corrector) is used in said boost converter system.

15. The method for calculating the point of time of the zero current state of said storage inductor comprising:

providing a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through said storage inductor and a rectifying means for rectifying the output voltage; and a digital control means to control frequency and pulse width of said shunt switch;

measuring the input voltage;

turning on said shunt switch for a time;

opening said shunt switch after said time;

measuring of the input voltage and the voltage on the load side immediately after said shunt switch has been opened, if switching intervals are short related to the source frequency said measurements can be performed at same time as above mentioned measurement of the input voltage just before turning on the shunt switch;

calculating said point of time of the zero current state; and

adding the said point of time of the zero current state to the point of the falling edge of the said time and add additionally a safety margin, if required, to get the point of time when said switch can be closed again.

16. The method of Claim **15** wherein said rectifying means is a rectifying diode

and the calculation of said point of time of zero current **TTR** =

$$\frac{U_1 * T_{on}}{Uc + 0.7V - U_1}$$ wherein **U1** is the measured voltage at the source side and **UC** is the voltage measured at the load side and **TON** is the pulse width of the said shunt switch.

17. The method for the fine-adjustment of the energy transfer by fine-tuning the pulse width of a shunt switch comprising:

providing a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through said storage inductor, a rectifying means for rectifying the output voltage and voltage dividers at the source side, the load side and at the load side of the inductor, a A/D converter to convert the measurement results to digital values and a digital control means to control frequency and pulse width of said shunt switch;

measuring the voltage at the load side;

comparing said voltage at the load side with a reference voltage;

adjusting the energy transferred through corrections of the ON time of said shunt switch according to the results of said comparisons to achieve equivalence between the output voltage and the reference voltage; and

toggling between neighbouring values of the ON time of the shunt switch **TON** to achieve fine-tuning of the energy transferred by averaging of ON time values in case of small differences between the voltage at the load side **UC** and the reference voltage **UREF.**

18. The method of calculating the point of time of the zero current state of a

storage inductor and of fine-adjusting the energy transfer by fine-tuning of the pulse width of a shunt switch comprising:

providing a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through said storage inductor, a rectifying means for rectifying the output voltage and voltage dividers at the source side, the load side and at the load side of the inductor, a A/D converter to convert measurement results and reference voltages to digital values and a digital control means to control frequency and pulse width of said shunt switch;

measuring the input voltage;

turning on said shunt switch for a time;

opening said shunt switch after said time;

measuring of the input voltage and the voltage on the load side immediately after said shunt switch has been opened, if switching intervals are short related to the source frequency said measurements can be performed at same time as above mentioned measurement of the input voltage just before turning on the shunt switch;

comparing said voltage at the load side with a reference voltage;

adjusting the energy transferred through corrections of the ON time of said shunt switch according to the results of said comparisons to achieve equivalence between the output voltage and the reference voltage;

toggling between neighboring values of the ON time of the shunt switch **TON** to achieve fine-tuning of the energy transferred by averaging of ON time values in case of small differences between the voltage at the load side and the reference voltage;

calculating said point of time of the zero current state; and

adding the said point of time of the zero current state to the point of the falling edge of the said time and add additionally a safety margin, if required, to get the point of time when said switch can be closed again.

19. The method of claim **18** wherein a diode is used for rectifying and the point of time of zero current is calculated using the equation **TTR** = $\frac{U_1 * T_{on}}{U_C + 0.7V - U_1}$ wherein **U1** is the measured voltage at the source side and **Uc** is the voltage measured at the load side and **TON** is the pulse width of the said shunt switch.

20. The method to improve the accuracy of the measurement of the voltages required to control the system as e.g. the frequency and the pulse width of the shunt switch is achieved by a calibration of the tolerances of voltage dividers e.g. at the load side, the inductor side and at the source side at appropriate periods of time through a measurement of the voltage divider ratio considering the small influence of the voltage of the forward bias of the diode hence enabling the usage of tolerant voltage dividers comprising:

providing a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through said storage inductor, a rectifying means for rectifying the output voltage and voltage dividers at the source side, the load side and at the load side of the inductor, a A/D converter to convert the measurement results to digital values and a digital control means to calibrate the voltage divider ratios;

measuring the ratios of the voltage dividers at the source side and at the load side of the storage inductor during the short time period when no current is flowing through the inductor;

measuring the ratios of the voltage dividers at the output side of the boost converter and at the output side of the storage inductor during the period of time energy is transferred and the rectifying means is forward biased and hence the voltage at e.g. the diode is low compared to the voltages measured; and

calibrating the voltage divider ratios throughout the operation of the boost converter and considered to define the real value of the voltages required to control the whole system.

21. The method of the fine adjustment of the energy transfer by fine-tuning the pulse width of the shunt switch combined with the method of the improved accuracy of the measurement of the voltages by calibrating the tolerances of the voltage divider on the load side comprising;

providing a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through said storage inductor, a rectifying means for rectifying the output voltage and voltage dividers at the source side, the load side and at the load side of the inductor, an A/D converter to convert measurement results and reference voltages to digital values and a digital control means to control frequency and pulse width of said shunt switch;

measuring the ratios of the voltage dividers at the output side of the boost converter during the period of time energy is transferred;

measuring the voltage at the load side;

comparing said voltage at the load side with a reference voltage;

adjusting the energy transferred through corrections of the ON time of said shunt switch according to the results of said comparisons to achieve equivalence between the output voltage and the reference voltage; and toggling between neighbouring values of the ON time of the shunt switch **TON** to achieve fine-tuning of the energy transferred by averaging of ON time values in case of small differences between the voltage at the load side **UC** and the reference voltage **UREF.**

22. The method of calculating the point of time of the zero current state of the storage inductor together with the improvement of the accuracy of the measurement of the voltages involved by a calibration of voltage dividers comprising;

providing a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through said storage inductor, a rectifying means for rectifying the output voltage and voltage dividers at the source side, the load side and at the load side of the inductor, an A/D converter to convert measurement results and reference voltages to digital values and a digital control means to control frequency and pulse width of said shunt switch;

measuring the ratios of the voltage dividers at the source side and at the load side of the storage inductor during the short time period when no current is flowing through the inductor;

measuring the input voltage considering the measured ratios of the voltage divider at the source side;

turning on said shunt switch for a time;

opening said shunt switch after said time;

measuring the ratios of the voltage dividers at the output side of the boost converter and at the output side of the storage inductor during the period of time energy is transferred and the rectifying means is forward biased and hence the voltage at e.g. the diode is low compared to the voltages measured;

measuring of the input voltage and the voltage on the load side immediately after said shunt switch has been opened considering the measured ratios of the voltage dividers at the source and at the load side, if switching intervals are short related to the source frequency said measurements can be performed at same time as above mentioned measurement of the input voltage just before turning on the shunt switch;

calculating said point of time of the zero current state; and

adding the said point of time of the zero current state to the point of the falling edge of the said time and add additionally a safety margin, if required, to get the point of time when said switch can be closed again.

23. The method of Claim **22** wherein a diode is used for rectifying and the point of time of zero current is calculated using the equation

TTR = $\frac{U_1 * T_{on}}{Uc + 0.7V - U_1}$ wherein **U1** is the measured voltage at the source side and **Uc** is the voltage measured at the load side and **TON** is the pulse width of the said shunt switch.

24. The method of calculating the point of time of the zero current state of the storage inductor together with the method of a fine adjustment of the energy transfer by fine-tuning of the pulse width of the shunt switch and additionally with the method of an improvement of the accuracy of the measurement of the voltages by a calibration of the voltage dividers comprising;

providing a boost converter which includes a storage inductor coupled to an input voltage, a shunt switch controlling a current flowing through said storage inductor, a rectifying means for rectifying the output voltage and voltage dividers at the source side, the load side and at the load side of the inductor, an A/D converter to convert measurement results and reference voltages to digital values and a digital control means to control frequency and pulse width of said shunt switch;

measuring the input voltage;

turning on said shunt switch for a time;

opening said shunt switch after said time;

measuring of the input voltage and the voltage on the load side immediately after said shunt switch has been opened, if switching intervals are short related to the source frequency said measurements can be performed at same time as above mentioned measurement of the input voltage just before turning on the shunt switch;

comparing the measured voltage at the load side with the reference voltage;

adjusting the energy transferred through corrections of the ON time of said shunt switch according to the results of said comparisons to achieve equivalence between the output voltage and the reference voltage;

toggling between neighboring values of the ON time of the shunt switch **TON** to achieve fine-tuning of the energy transferred by averaging of ON time values in case of small differences between the voltage at the load side and the reference voltage;

calculating said point of time of the zero current state;

calculating said point of time of the zero current state; and

adding the said point of time of the zero current state to the point of the falling edge of the said time and add additionally a safety margin, if required, to get the point of time when said switch can be closed again.

25. The method of Claim **24** wherein a diode is used for rectifying and the point of time of zero current is calculated using the equation

TTR = $\frac{U_1 * T_{on}}{Uc + 0.7V - U_1}$ wherein **U1** is the measured voltage at the source side and **UC** is the voltage measured at the load side and **TON** is the pulse width of the said shunt switch.